



# Businesses Concentrate Their R&D in a Small Number of Geographic Areas in the United States

by Brandon Shackelford<sup>1</sup>

**B**usinesses perform a large share of their research and development in a small number of geographic areas, two of the largest being the San Jose-San Francisco-Oakland combined statistical area (CSA) and the New York-Newark-Bridgeport CSA, according to data from the Business R&D and Innovation Survey (BRDIS).<sup>2</sup> This finding is based on data reported by the subset of all BRDIS respondents known to have performed \$3 million or more of R&D in the United States in any of the 4 years preceding 2008 (hereafter referred to as large-R&D companies).<sup>3</sup>

Although estimates of the total amount of business R&D performed in each metropolitan area are not yet available, data are available for large-R&D companies, which account for the majority of R&D performed in the United States. In 2008 a total of 2,370 of these large-R&D companies responded to new questions in BRDIS asking companies to report the address of their largest R&D location in the United States and the amount of R&D performed at that location. Nineteen percent of these large-R&D companies reported that their largest R&D location was in either the San Jose-San

Francisco-Oakland CSA or the New York-Newark-Bridgeport CSA; in these two areas alone, large-R&D companies performed at least \$29.3 billion of R&D (table 1). These new BRDIS data allow policymakers and researchers to explore patterns in R&D spending in greater geographic detail than previously available, and they provide new insight into how companies organize their R&D activities. This InfoBrief highlights early findings from these data and discusses geographic patterns of business R&D within the United States.

## Largest U.S. Locations for Business R&D

The 2,370 large-R&D companies that responded to the questions about their largest (or primary) R&D location accounted for 74% of the \$232.5 billion of R&D performed in the United States in 2008 that was paid for by the performing companies (own R&D expense). These companies performed an estimated \$100.5 billion of this R&D at their primary R&D locations alone. The R&D reported at primary R&D locations provides lower-bound estimates for business R&D performed in major metropolitan areas. The 23

geographic areas listed in table 1 were each home to the primary R&D locations of at least 25 large-R&D companies, almost 1,700 companies in total. Together, these 23 areas account for over three-quarters of the R&D performed by large-R&D companies at their primary locations. California and Texas, the two most populous states, each had three geographic areas represented in table 1.

The three geographic areas where the largest amount of R&D was performed by large-R&D companies at their primary R&D locations were the San Jose-San Francisco-Oakland, New York-Newark-Bridgeport, and Seattle-Tacoma-Olympia CSAs. The largest R&D industries represented in these areas vary widely, with San Jose-San Francisco-Oakland dominated by computer and electronic products manufacturers, New York-Newark-Bridgeport dominated by pharmaceutical and chemicals companies, and Seattle-Tacoma-Olympia dominated by information technology and aerospace companies. Perhaps not coincidentally, these areas were also among the largest in terms of U.S. patenting based on the residence of inventors.<sup>4</sup>

TABLE 1. Business R&D performed and paid for by large-R&D companies, by geographic area of largest R&D location: 2008  
(Dollars in millions)

CSA or MSA	Companies reporting largest R&D location	R&D performance at largest R&D location	Total U.S. R&D performance
All largest locations	2,370	100,505	171,024
San Jose-San Francisco-Oakland, CA CSA	289	18,071	26,553
Boston-Worcester-Manchester, MA-RI-NH CSA	182	4,798	6,715
Los Angeles-Long Beach-Riverside, CA CSA	171	6,856	12,621
New York-Newark-Bridgeport, NY-NJ-CT-PA CSA	170	11,207	19,621
Chicago-Naperville-Michigan City, IL-IN-WI CSA	93	2,833	7,407
Minneapolis-St. Paul-St. Cloud, MN-WI CSA	72	1,949	4,962
San Diego-Carlsbad-San Marcos, CA MSA	68	2,655	3,466
Detroit-Warren-Flint, MI CSA	65	6,857	9,193
Philadelphia-Camden-Vineland, PA-NJ-DE-MD CSA	64	3,324	9,089
Washington-Baltimore-Northern Virginia, DC-MD-VA-WV CSA	58	995	1,788
Seattle-Tacoma-Olympia, WA CSA	56	9,377	11,212
Houston-Baytown-Huntsville, TX CSA	45	1,581	5,309
Atlanta-Sandy Springs-Gainesville, GA-AL CSA	44	705	1,109
Portland-Vancouver-Hillsboro, OR-WA MSA	33	691	1,012
Milwaukee-Racine-Waukesha, WI CSA	32	810	986
Denver-Aurora-Boulder, CO CSA	31	359	597
Raleigh-Durham-Cary, NC CSA	31	701	928
Pittsburgh-New Castle, PA CSA	30	311	535
Dallas-Fort Worth, TX CSA	30	982	3,867
Cleveland-Akron-Elyria, OH CSA	28	658	1,335
Phoenix-Mesa-Glendale, AZ MSA	28	832	2,101
St. Louis-St. Charles-Farmington, MO-IL CSA	28	706	1,346
Austin-Round Rock-Marble Falls, TX CSA	27	2,113	7,064
All other geographic areas reported as largest location	695	21,217	32,211

CSA = combined statistical area; MSA = metropolitan statistical area.

NOTES: Data are for companies known to have performed at least \$3 million of R&D in prior years (large-R&D companies) that reported their largest R&D location. Only geographic areas where at least 25 companies report their largest location are listed. The difference between the next-to-last and last columns should not be interpreted as R&D performed in other geographic areas, because companies may perform R&D at other locations within the same geographic area as their largest location.

SOURCE: National Science Foundation/National Center for Science and Engineering Statistics and U.S. Census Bureau, Business R&D and Innovation Survey, 2008.

The San Jose-San Francisco-Oakland CSA, home to Silicon Valley, not only was the site with the highest level of R&D performance among large-R&D companies, but it also was the most commonly reported primary R&D location. The Boston-Worcester-Manchester and the Los Angeles-Long Beach-Riverside CSAs were the next most commonly reported areas. Although these two CSAs are home to many large-R&D companies, neither is clearly dominated by a single company or industry in terms of R&D. However, both of these CSAs are home to multiple world-renowned research universities.

The BRDIS data for companies' primary R&D locations highlights how companies tend to concentrate their R&D activities geographically. Of the large-R&D companies that had more than one business establishment (multi-units), 25% reported performing 100% of their U.S. R&D at their largest location and 80% reported performing at least 50% at that location.<sup>5</sup>

### Industry Detail for Top States

Business R&D is concentrated in a small number of states. Of the \$232.5 billion of R&D performed in the United States in 2008 that was paid for by the

performing companies, \$156.6 billion was performed in the 10 states with the highest levels of R&D performance (top 10 states) (table 2).<sup>6</sup> California alone accounted for 23% of the U.S. total and half of the R&D performed by semiconductor companies in the United States. Among the top 10 states, the only other one that accounted for at least half of an industry's U.S. R&D was Michigan, which accounted for 71% of the R&D performed by automobile manufacturers in the United States.

A single industry dominates the business R&D of 4 of the top 10 states in

TABLE 2. Top 10 states with the highest level of business R&D performed and paid for by the companies, by prominent industries in state: 2008  
(Dollars in millions)

State and industry	NAICS code	R&D performance	State and industry	NAICS code	R&D performance
All states			Michigan		
All industries	21–23, 31–33, 42–81	232,505	All industries	21–23, 31–33, 42–81	12,105
Pharmaceuticals, medicines	3254	45,169	Automobiles, bodies, trailers, parts	3361, 3362, 3363	8,698
Software publishers	5112	27,665	Machinery	333	584
Semiconductor, other electronic components	3344	21,588	Basic chemicals	3251	377
California			New York		
All industries	21–23, 31–33, 42–81	54,231	All industries	21–23, 31–33, 42–81	9,061
Semiconductor, other electronic components	3344	10,835	Software publishers	5112	1,717
Pharmaceuticals, medicines	3254	7,583	Pharmaceuticals, medicines	3254	1,472
Software publishers	5112	6,871	Computer, peripheral equipment/other computer, electronic products	3341, 3343, 3346	D
New Jersey			Connecticut		
All industries	21–23, 31–33, 42–81	17,331	All industries	21–23, 31–33, 42–81	8,938
Pharmaceuticals, medicines	3254	12,651	Pharmaceuticals, medicines	3254	6,482
Computer systems design, related services	5415	500	Aerospace products, parts	3364	795
Scientific R&D services	5417	495	Machinery	333	257
Texas			Pennsylvania		
All industries	21–23, 31–33, 42–81	12,830	All industries	21–23, 31–33, 42–81	8,783
Semiconductor, other electronic components	3344	2,804	Pharmaceuticals, medicines	3254	3,647
Software publishers	5112	1,818	Navigational, measuring, electromedical, control instruments	3345	587
Computer, peripheral equipment/other computer, electronic products	3341, 3343, 3346	1,044	Computer systems design, related services	5415	423
Washington			Illinois		
All industries	21–23, 31–33, 42–81	12,724	All industries	21–23, 31–33, 42–81	7,984
Software publishers	5112	6,533	Pharmaceuticals, medicines	3254	2,477
Aerospace products, parts	3364	D	Machinery	333	2,012
Pharmaceuticals, medicines	3254	614	Navigational, measuring, electromedical, control instruments	3345	398
Massachusetts					
All industries	21–23, 31–33, 42–81	12,625			
Pharmaceuticals, medicines	3254	3,001			
Software publishers	5112	1,711			
Scientific R&D services	5417	1,658			

D = data withheld to avoid disclosing operations of individual companies.

NAICS = 2002 North American Industry Classification System.

NOTES: Industry classification based on dominant business code for domestic R&D performance where available. For companies that did not report business codes, classification used for sampling was assigned. State and industry rankings are based on point estimates and do not take into account survey sample variance.

SOURCE: National Science Foundation/National Center for Science and Engineering Statistics and U.S. Census Bureau, Business R&D and Innovation Survey, 2008.

table 2. The software industry, which performed 12% of U.S. business R&D, accounted for 51% of Washington's total. Automobile manufacturers account for only 5% of the nation's total business R&D but perform 72% of Michigan's. The pharmaceutical industry is dominant in New Jersey and Connecticut, accounting for 73% of the

business R&D performed in both states. The pharmaceutical industry performs more R&D in the United States than any other industry (19% of the U.S. total) and is a prominent R&D industry in 8 of the top 10 states (all but Texas and Michigan). Together, these eight states account for 84% of the pharmaceutical R&D in the United States.

## Patterns in State R&D Shift Over Time

The top 10 states account for almost the same share of total business R&D performance in the United States as they did 20 years ago, but the relative position of the states has shifted (table 3).<sup>7</sup> States that saw the most dramatic growth in business R&D between 1987

and 2008 are the ones that are today dominated by industries that were in a nascent state in the 1980s. California—the largest state in 1987 in terms of business R&D performed by companies and funded by company and other nonfederal sources—experienced more business R&D growth in absolute terms than any other state between 1987 and 2008 (table 3). After adjustment for inflation, California's business R&D more than quadrupled. It grew much faster than the nation's as a whole, which saw business R&D grow by a factor of 2.3 during the same period. Washington, which was not among the top 10 states for business R&D in 1987, saw its business R&D grow at an even faster rate than California's, increasing by over a factor of about five during the same period. Of the top R&D states in 2008, Texas and Connecticut also saw their business R&D grow faster during this period than the nation's as a whole.

In 1987 Michigan was a close second to California in business R&D, but by 2008 the amount of business R&D in Michigan was less than one-quarter of the amount in California. Reflecting the relatively slow growth of the automotive industries' R&D in the United States, business R&D in Michigan grew at a slower rate than the nation's as a whole. After adjustment for inflation, Michigan's business R&D was only 9% higher in 2008 than in 1987.

Because state economies vary in size, it is not always appropriate to directly compare R&D expenditures among states. Likewise, it is important to keep in mind that the composition and size of a state's economy change over time when analyzing patterns in state R&D. One way of controlling for the size of each state's economy is to measure each state's business R&D as a percentage of its gross domestic product (GDP). That

percentage is referred to as R&D intensity, or R&D concentration.

Overall, the U.S. ratio of business R&D (excluding federally funded R&D) to GDP was 1.8% in 2008, up from 1.4% in 1987 (table 3). California's business R&D intensity was equal to the U.S. average in 1987 but was much higher (3.1%) in 2008, indicating that over this period California's business R&D grew faster than the overall economy. Washington, Connecticut, New Jersey, and Massachusetts had the highest R&D intensities of the top 10 states in 2008. Like California, Washington and Connecticut both saw their business R&D intensity more than double between 1987 and 2008. Only 3 of the top 10 states for business R&D in 2008 had R&D intensities substantially below that of the nation as a whole: Texas, New York, and Illinois. These below-average R&D intensi-

TABLE 3. Top 10 states with the highest level of business R&D performed and paid for by all nonfederal sources of funds: 2008 and 1987

State	2008			1987		
	R&D performance (constant			R&D performance (constant		
	Rank	2008 \$millions) <sup>a</sup>	R&D/GDP (%)	Rank	2008 \$millions) <sup>b</sup>	R&D/GDP (%)
U.S. total	-	254,321	1.8	-	108,536	1.4
California	1	58,633	3.1	1	14,235	1.4
New Jersey	2	18,790	3.9	3	9,505	3.3
Texas	3	14,061	1.2	9	4,142	0.8
Massachusetts	4	13,556	3.7	5	6,729	2.9
Michigan	5	13,366	3.6	2	12,208	4.3
Washington	6	13,159	3.9	14	2,189–2,697	1.5–1.8
New York	7	9,937	0.9	4	8,311	1.2
Pennsylvania	8	9,426	1.7	7	5,435	1.6
Connecticut	9	8,938–9,822	4.0–4.4	12	2,649	1.9
Illinois	10	8,573	1.4	6	5,592	1.5
North Carolina	11	5,979	1.5	10	2,903	1.5
Ohio	12	5,955	1.3	8	4,694	1.5
Undistributed	-	13,981	na	-	2,512	na

na = not applicable.

GDP = gross domestic product.

<sup>a</sup> Includes company's own funds (R&D expense) and any other nonfederal sources, such as R&D paid for by business partners or customers.

<sup>b</sup> 1987 dollars were increased by a factor of 1.6723 to represent inflation-adjusted 2008 dollars.

NOTES: State rankings are based on point estimates and do not take into account survey variance. Ranges are listed under R&D performance when exact value is withheld to avoid disclosing operations of individual companies. Ranking is based on midpoint of range.

SOURCE: National Science Foundation/National Center for Science and Engineering Statistics and U.S. Census Bureau, Business R&D and Innovation Survey, 2008; National Science Foundation/Division of Science Resources Studies and U.S. Census Bureau, Survey of Industrial Research and Development, 1987; GDP data are from the U.S. Bureau of Economic Analysis.

ties reflect a higher concentration of less R&D-intensive industries within these states: oil and gas extraction in Texas, financial services in New York, and wholesale trade and financial and professional services in Illinois.<sup>8</sup>

## Data Sources and Limitations

The sample for BRDIS was selected to represent all for-profit companies with more than five domestic employees, publicly or privately held, that perform or fund R&D or engage in innovative activities in the United States. For 2008 a total of 39,553 companies were sampled, representing 1,926,012 companies in the population. Because the statistics from the survey are based on a sample, they are subject to both sampling and nonsampling errors.

For this InfoBrief, estimates for R&D at companies' largest locations represent only the amounts for companies responding to the item. No estimation has been made to correct for item nonresponse or for R&D performed at these locations as non-primary locations. Further, the totals reported here do not include R&D performed by these companies that is paid for by others.

In 2008 more than 5% of business R&D in the United States could not be assigned to a specific state location. Therefore, state R&D data provided here are lower-bound estimates. State and industry rankings are based on point estimates and do not take into account the variance of the survey sample. Data presented here for metropolitan areas are from a subset of companies in the survey sample (large-R&D companies only) and therefore are not estimates of the total business R&D in these areas. The National Science Foundation and the U.S. Census Bureau continue to research methods of producing population estimates for

business R&D within these and other geographic areas.

For an overview of worldwide R&D data collected by BRDIS see the following InfoBrief from the National Center for Science and Engineering Statistics: *Business R&D Performed in the United States Cost \$291 Billion in 2008 and \$282 Billion in 2009* (NSF 12-309) at <http://www.nsf.gov/statistics/infbrief/nsf12309/>. Detailed tables for the 2008 and 2009 BRDIS are forthcoming and will be available at <http://www.nsf.gov/statistics/industry/>. Individual tables may be available in advance of publication of the full report.

## Notes

1. Brandon Shackelford is principal consultant at Twin Ravens Consulting, Austin, TX. For further information, contact Raymond M. Wolfe, Research and Development Statistics Program, National Center for Science and Engineering Statistics, National Science Foundation, 4201 Wilson Boulevard, Suite 965, Arlington, VA 22230 ([rwolfe@nsf.gov](mailto:rwolfe@nsf.gov); 703-292-7789).

2. Combined statistical areas (CSAs) are defined by the Office of Management and Budget as groups of adjacent core based statistical areas (CBSAs) that are linked by commuting ties (<http://www.census.gov/population/www/metroareas/metrodef.html>). Some metropolitan statistical areas (MSAs), such as San Diego, California, and Portland, Oregon, are not part of a defined CSA. For the purpose of this InfoBrief, these MSAs are treated as equivalent to a CSA.

3. Because of their past R&D, these large-R&D companies were selected with certainty for the 2008 BRDIS sample with sample weights equal to 1.

4. U.S. Patent and Trademark Office. 2011. Patenting in technology classes: breakout by origin, U.S. metropolitan and micropolitan areas: count of 2006–2010 utility patent grants, as distributed by calendar year of grant with patent counts based on the primary patent classification ([http://www.uspto.gov/web/offices/ac/ido/oeip/taf/cls\\_cbsa/allcbsa\\_gd.htm](http://www.uspto.gov/web/offices/ac/ido/oeip/taf/cls_cbsa/allcbsa_gd.htm)).

5. This concentration is less pronounced among the very largest R&D performers, but most of these companies still report performing the majority of their U.S. R&D at their primary location.

6. This section focuses on the geographic distribution of R&D that is both performed by and paid for by the same company. The total amount of R&D performed by companies in the United States, which includes R&D paid for by others, was \$290.7 billion in 2008. State-level estimates are available for R&D performed by companies that are paid for by others, but some of these data are suppressed to protect company confidentiality and estimates for federally funded R&D have high imputation rates.

7. To maintain comparability with statistics from 1987, the business R&D data presented in this section differ from those presented earlier in the InfoBrief. These state totals include R&D performed by companies that was paid for by nonfederal customers and business partners (R&D performed by companies from company and other sources of funds).

8. Industry concentration was determined based on data from the U.S. Census Bureau 2007 Economic Census.

RETURN THIS COVER SHEET TO ROOM P35 IF YOU  
DO NOT WISH TO RECEIVE THIS MATERIAL ☐ OR  
IF CHANGE OF ADDRESS IS NEEDED ☐ INDICATE  
CHANGE INCLUDING ZIP CODE ON THE LABEL (DO  
NOT REMOVE LABEL).

**National Science Foundation**  
ARLINGTON, VA 22230  
OFFICIAL BUSINESS

NSF 12-326